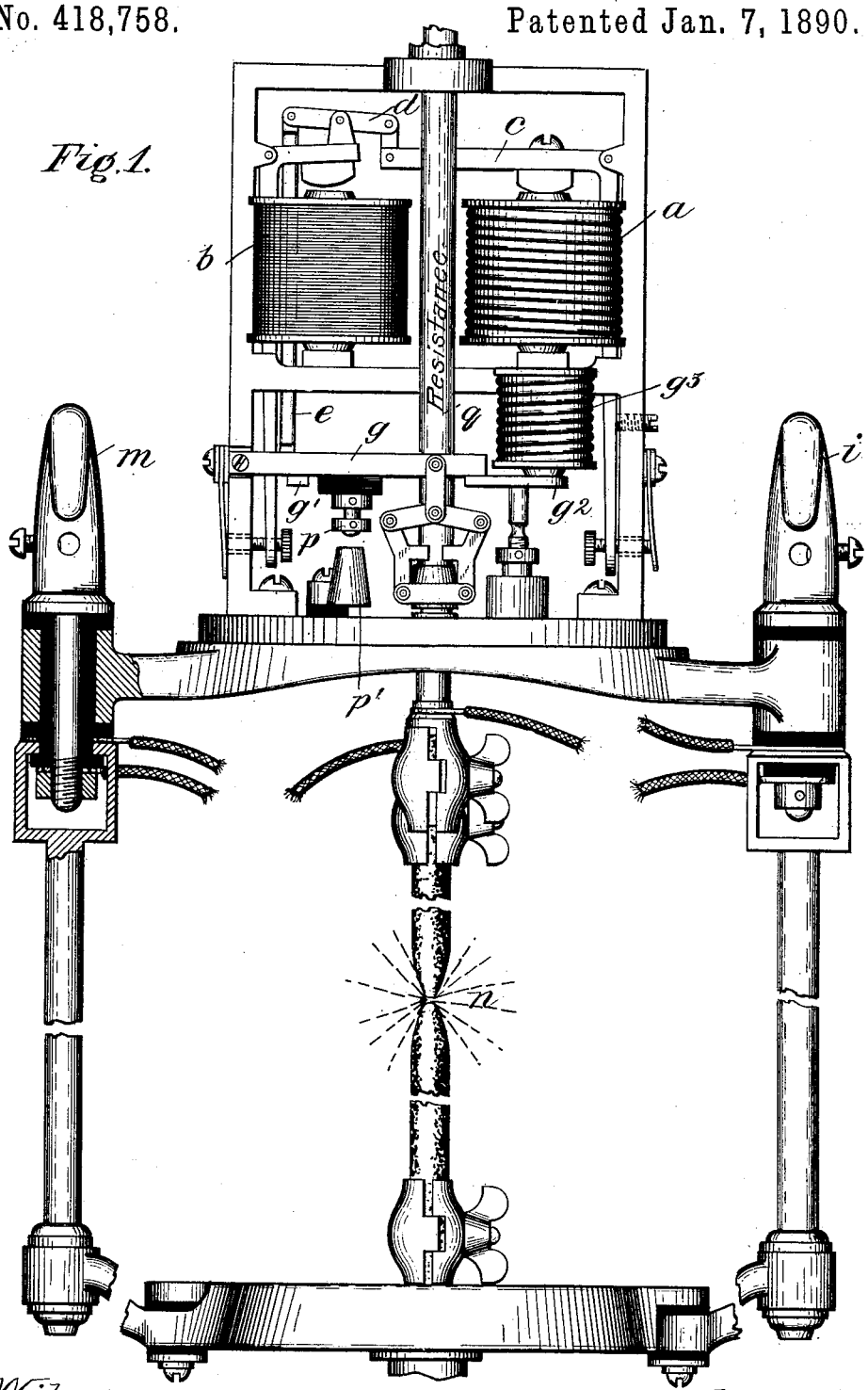
(No Model.) 3 Sheets—Sheet 1.

C. E. SCRIBNER.

ELECTRIC ARC LAMP.

No. 418,758. Patented Jan. 7, 1890.

Fig. 1.



Witnesses:
Saml. B. Dover.
L. Lamer.

Inventor:
Charles E. Scribner
By Fred. P. Barton
Atty.

(No Model.) 3 Sheets—Sheet 2.

C. E. SCRIBNER.

ELECTRIC ARC LAMP.

No. 418,758. Patented Jan. 7, 1890.

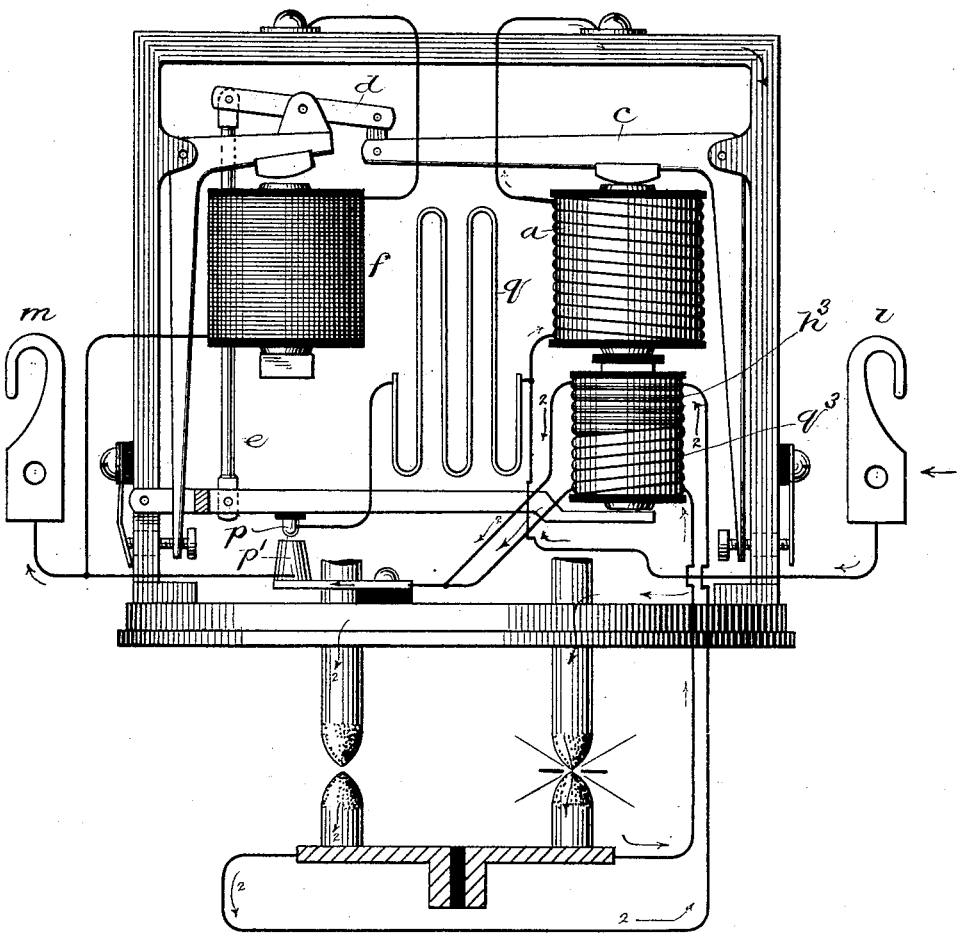


Fig. 2.

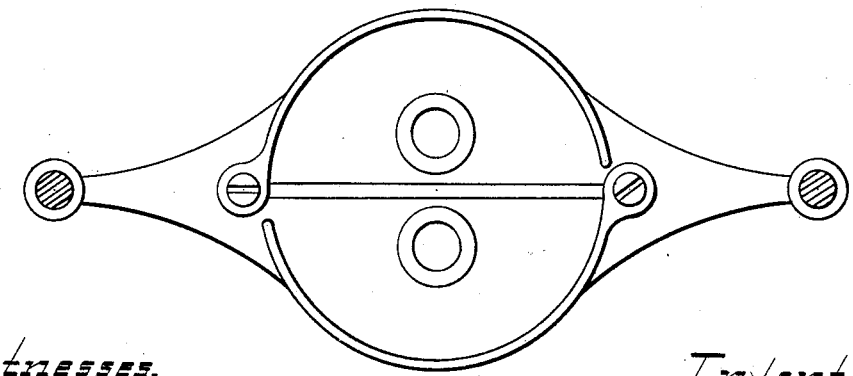


Fig. 3.

Witnesses.
C. G. Hawley.
Geo. R. Parker.

Inventor:
Charles E. Scribner.
By. George P. Barton
Attorney.

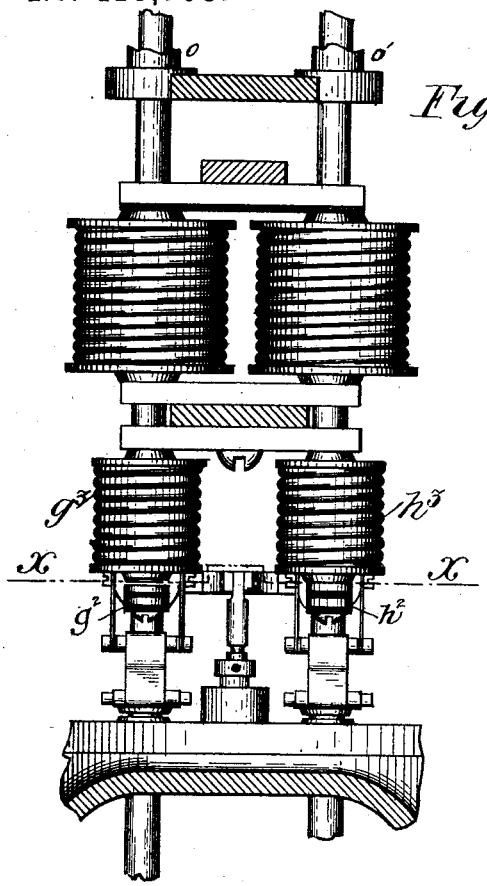
(No Model.) 3 Sheets—Sheet 3.

C. E. SCRIBNER.

ELECTRIC ARC LAMP.

No. 418,758. Patented Jan. 7, 1890.

Fig. 4.



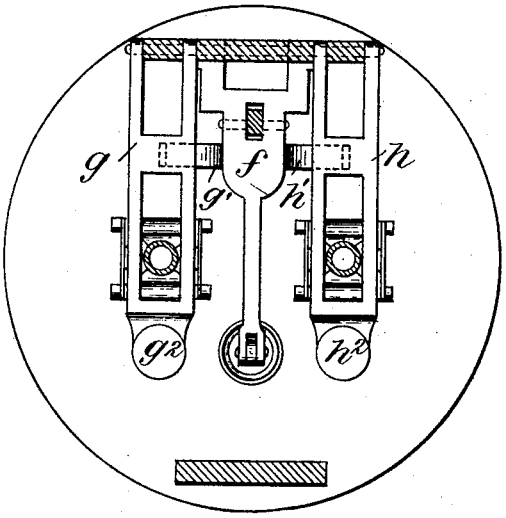
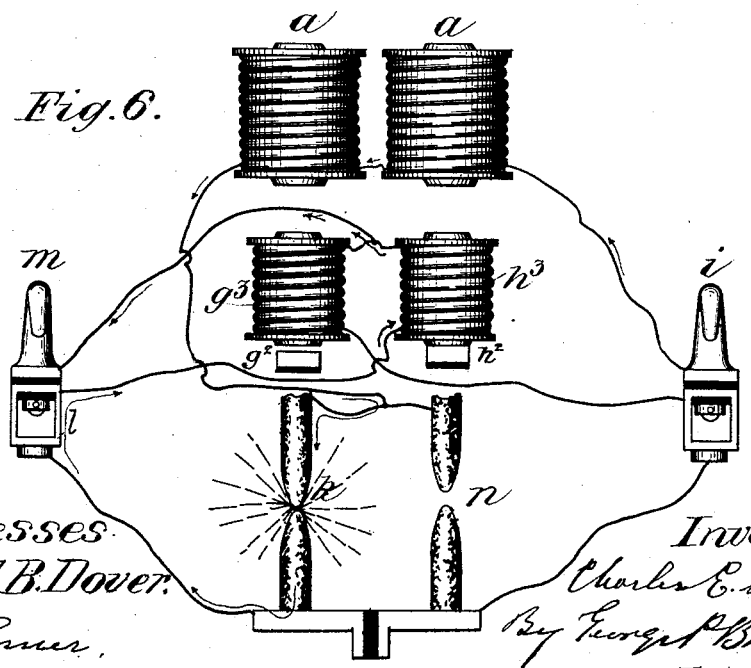


Fig. 5.

Fig. 6.



Witnesses
Sam'l B. Dover.
L. Parmer.

Inventor:
Charles E. Scribner
By George P. Barton
Attorney

UNITED STATES PATENT OFFICE.

CHARLES E. SCRIBNER, OF CHICAGO, ILLINOIS, ASSIGNOR TO THE WESTERN ELECTRIC COMPANY, OF SAME PLACE.

ELECTRIC-ARC LAMP.

SPECIFICATION forming part of Letters Patent No. 418,758, dated January 7, 1890.

Application filed July 2, 1886. Serial No. 206,979. (No model.)

To all whom it may concern:

Be it known that I, CHARLES E. SCRIBNER, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a certain new and useful Improvement in Double-Carbon Arc Lamps, (Case 109,) of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

My invention relates to that class of electric-arc lights in which two sets of carbons are employed, the different sets being so arranged that one set will be practically consumed before the carbons of the other set are brought into service.

Heretofore various forms of electric-arc lamps have been employed. As usually constructed, the carbon points are at first placed so as to be in contact. When the current is established, the points are moved apart a sufficient distance to produce the arc. As the carbons are consumed the carbon points must be fed together, so as to maintain the arc as nearly constant as possible.

The construction of all double-carbon lamps generally in use adapted to burn in series has been such that the arc has gradually increased in length as the weight has been removed by the consumption of the carbons.

The object of my invention is to improve the action of such double-carbon arc lamps, so that a uniform length of arc may be maintained during the whole time the lamp is burning, and at the same time render the lamps more sensitive and certain in their operation. This I accomplish by relieving the set of carbons that may be burning, whether one set or the other, from the weight or influence of the idle set. Thus, relieving the special regulating mechanism of the set that is burning from the influence or weight of the special regulating and feeding mechanism of the other set, I am enabled to keep the arcs of the different sets practically of the same average length, and at the same time cause my lamp to burn, whether one set or the other may be in service, as steadily as a single-carbon lamp until both sets of carbons are consumed.

In a prior application now pending, Serial No. 116,102, filed December 31, 1883, Case 70, I have described and claimed balance-lever mechanism in connection with the coarse-wire magnet and the fine-wire magnet in the shunt around the arc for regulating and feeding the carbons in a single-arc lamp. In my invention herein I preferably employ this system of leverage in connection with a lifting-magnet and magnet in the shunt around the arc and specially-designed clutching, shifting, and retaining mechanism for operating the carbons of the two sets and causing the arc to be transferred from the first set to the second after the carbons of the first set, taking the arc upon the initial starting, have been practically consumed.

The special feeding and retaining mechanism of the different carbon-rods in my lamp is the same—that is to say, the two sides of my lamp are symmetrical the one with the other.

The action of the feeding and regulating mechanism is precisely the same whether the arc is burning on one side or upon the other, and it is matter of indifference determined by the accidental resistance of the two sets of carbons which set takes the arc when current is first closed through the lamp.

Among the special features of my invention herein I would mention the lifting lever or yoke supporting normally the two clutch-levers placed on opposite sides thereof. At the free end of each of the clutch-levers is placed a soft-iron armature, and above these armatures are placed the retaining-magnets, respectively. These retaining-magnets are provided with circuits so arranged that when one arc is burning the retaining-magnet of the idle pair of carbons will be in circuit therewith. When the lamp is first brought into circuit, the central lifting lever or yoke is raised, and with it both clutch-levers, so as to separate at the same time the members of the two sets of carbons. For reasons well understood two arcs will not persist in different sides of the same parallel circuit. Therefore only one persisting arc is formed, the location thereof as between one set or the other being determined by the accidental resistance in the different sides of the parallel circuit. The

members of the pair which do not take the arc are, however, separated, and the armature of the clutch-lever of the idle rod is brought within the active influence of the pole of its retaining-magnet, which retaining-magnet, as before stated, is now energized. This energized retaining-magnet is now of sufficient force to attract its armature, thus lifting the clutch-lever of the idle rod from the yoke or central lifting-lever. In this position the clutch-lever of the idle rod is held until the carbons of the set first to take the arc are practically consumed, whereupon the arc is shifted to the other set in the following manner: The rod of the pair first to burn is provided with a stop, which stop comes against the frame of the lamp, preventing any further feeding of the upper carbon. The arc thereupon increases in length until finally it goes out. The arc being thus extinguished, its circuit is interrupted and the retaining-magnet of the other set is demagnetized, thus permitting the clutch-lever of the unburned set to fall. The fresh set of carbons are thus brought together and the circuit is again established through the lamp. The lifting-magnet performs its function of separating the second set of carbons and the new arc is established, while at the same time the retaining-magnet of the first set is brought into service. The armature of the clutch-lever of the first set, being brought within the active influence of the pole of its retaining-magnet, is attracted and the weight of its clutch and rod is taken off from the central lifting-lever. Thus the set of carbons last to burn is relieved from the influence of the rod, clutch, and clutch-lever of the burned set.

It is essential to the operation of my lamp that the lower members of the two sets of carbons should be insulated from each other. I therefore preferably form the globe-pan in two parts or sections insulated from one another, as hereinafter described.

It will be understood that I do not limit my invention to the balance lever mechanism herein described nor to the constructive details of the several parts, since my invention may be readily adapted to any of the well-known single-arc lamps now in use with only such modifications as would readily suggest themselves to those skilled in the art.

In the accompanying drawings, Figure 1 is a side elevation, partly in section, of a double-carbon arc lamp embodying my invention, certain parts thereof being broken away. Fig. 2 is a diagram showing the circuits in detail. Fig. 3 is a top view of the sectional globe-pan. Fig. 4 is a detailed view of the lifting-magnet and the retaining-magnets. Fig. 5 is a plan upon line $x\,x$ of Fig. 4, showing the lifting lever or yoke, the clutch-levers on opposite sides thereof provided with armatures, and the clutches carried thereby, respectively. Fig. 6 is a diagram showing the circuits of the lifting-magnet, the carbons, and the retaining-magnets.

Like parts are indicated by similar letters of reference throughout the different figures.

The lifting-magnet a is included in the main circuit, and the feeding-magnet b is included in a shunt of the arc in the usual manner. The armature of the lifting-magnet is linked by levers c d and rod e to the lifting-lever f. The lever d is pivoted upon the armature-lever of feed-magnet b, and motion of the armature of magnet b is communicated to the lifting-lever f through lever d and rod e. When current flows through magnet a, its armature is attracted and the motion is communicated to the lifting-lever f by levers c d and rod e, and through the lifting-lever f to the carbon-rods, thus separating the carbons and establishing the arc. As the arc increases in length the feed-magnet in the shunt of the arc becomes more strongly magnetized and its armature is attracted, and the motion of this armature is communicated through lever d and rod e to the lifting-lever f, and said lifting-lever is thereby lowered and a feed of the carbons effected.

Referring now to Fig. 5, it will be seen that the lifting-lever f is pivoted to the frame of the lamp. The clutches of the different rods are respectively carried by the clutch-levers g and h. These levers g and h are each separately pivoted to the frame and normally rest upon lugs g' h', provided upon the central lifting-lever f. At the free ends of the clutch-levers g and h are provided the armatures g^2 h^2, said armatures being controlled by the retaining-magnets g^3 h^3, respectively. These magnets g^3 h^3 are of course wire and provided with only a small number of turns, in order that, while sufficient to do the work required, they may not introduce any unnecessary resistance into the circuit. When the lifting-lever has been moved by the action of the magnet a, so as to separate the carbons, the armature of the excited retaining-magnet will be brought so near the pole of this magnet as to be drawn thereto. Thus, supposing the arc should be between the set n, retaining-magnet g^3 will be brought into circuit, and the armature g^2 having been brought within the active influence of the pole of retaining-magnet g^3 by the raising of the lever f said armature g^2 will be drawn to said pole and will be retained thereby, thus lifting clutch-lever g from lug g', so that lifting-lever f will be freed from the weight of lever g and the rod, carbon, and clutch carried thereby; and in like manner when the arc is established between the members of set k retaining-magnet h^3 will be energized, its armature h^2 will be brought within its active attractive force, so that clutch-lever h will be lifted from lug h', and the main lifting-lever f will be freed from the influence of the lever h, its clutch, rod, and carbon.

As shown more clearly in Fig. 6, the circuit from hook i may be traced through the lifting-magnet a, and thence in branches to the upper carbons of the different sets, and thence

through the set that is burning—in this instance set k—to the support of the lower carbon of set k, and thence, preferably through the insulated yoke l of hook m, to the retaining-magnet h^3, and after passing through said retaining-magnet the circuit may be traced back to the hook m and out. When the other pair or set n of the carbons is burning, the carbons of set k will be separated, and the circuit may be traced from the hook i through lifting-magnet a, through the arc of set n, thence to insulated yoke of hook i, and thence through magnet g^3, and thence, as before, to hook m and out. Thus when the arc is formed at set k, magnet h^3 will be energized. The retaining-magnet which is energized attracts its armature and holds apart the members of the set of carbons carried by the lever to which its said armature is attached. The separation of the carbons thus effected serves to hold open the circuit of the other retaining-magnet, which is thus made neutral, so as not to attract its armature while its set of carbons is burning. Thus, as shown in Figs. 4, 5, and 6, the circuit of retaining-magnet g^3 is open at n, and hence lever g rests upon the lug or portion g' of lever f, and any movement of lever f is communicated to lever g and thence to the clutch and rod of set k. Magnet h^3, being in the circuit of set k, is energized, and hence the carbons of set n are separated, as before described, and the weight of the lever h is taken off from the lever f. As before described, main lifting-lever f is connected with the armatures of the lifting and feeding magnets, and the motion for lifting or feeding given to said lever f is communicated to either lever g or h, accordingly as one or the other is resting upon said lever f.

Stops o o' are provided upon the carbon-rods to arrest the descent of the rods when the carbons are consumed. When either rod is thus arrested by its stop, its carbon continues to burn until the length of the arc is increased, and consequently its resistance, until finally sufficient current is shunted through the feed-magnet b to operate the automatic cut-out of the lamp.

The automatic cut-out which I preferably use is described in one of my prior pending applications, Serial No. 178,865, filed October 3, 1885, Case 100. This cut-out consists of contact-points, resistance, and circuits arranged to shunt the lamp when an arc of abnormal length is formed. This automatic cut-out also serves to shift the arc from one set to the other when the first set of carbons is consumed. This automatic cut-out and shifting mechanism will be readily understood by reference to Figs. 1 and 2, in which are shown the contact-points p p', which, when closed, form a circuit from hook i to hook m through resistance q. This resistance may be a stick of carbon or other well-known resistance and should be of about a quarter of an ohm. This resistance is mounted upon the frame of the lamp and is carried thereby. The contact-points p and p' are adjusted to close when an arc of abnormal length is formed.

In case the length of the arc is increased beyond the normal, as before stated, more and more current is shunted through feed-magnet b until its armature is attracted sufficiently to cause lever f to descend below the point at which a feed would take place if the rod were not held by its stop, and when lever f is thus caused to descend point p will be closed upon point p'. These points being closed, the lamp is shunted through resistance q and the arc extinguished. The retaining-magnet which was included in circuit with the arc thus put out will thereupon lose its magnetism. The armature of this retaining-magnet is thereupon released, and the clutch-lever which had been held by said armature falls and rests upon the lever f and the carbon-rod is released. Circuit is thus established through the second set of carbons—that is to say, when the lamp is shunted by the automatic cut-out the arc at k is extinguished, and the rod of set k being held by its stop o the circuit through retaining-magnet h^3 will be broken, thereby releasing the rod of set n. The carbons n, being thus brought together, bring the lamp again into circuit, and the lifting-magnets operate to cause the clutch to grasp the rod of set n and separate said set to establish the arc. The retaining-magnet g^3 being included in the arc thus established, its armature g^2 will be raised, thereby lifting lever g out of employment, together with the rod and upper carbon of set k. Lever f will be thus relieved from their weight. The lamp will then continue to burn until the carbons of the second set are consumed. Thereupon the rod of the second set will be held by its stop until finally the lamp will be again cut out, this time permanently, by the automatic cut-out.

As shown in Figs. 2 and 6, the supports of the lower carbons of the different sets are insulated from each other. I preferably use the form of support shown in Fig. 3, in which the two insulated sections form a globe-pan.

The clutches may be of any well-known construction.

It matters not which set of carbons may be burned first, the sequence of the burning being determined by the accidental difference in the resistance of the two sets of carbons, and the arc of the different sets will be of the same average length. Thus the lamp will give a uniformly steady and brilliant light during the entire time of its service.

Having thus described my invention, I claim as new and desire to secure by Letters Patent—

1. In an electric-arc lamp, the combination, substantially as hereinbefore described, of two sets or pairs of carbons in multiple arc or derived circuit with one another, the members of both pairs being normally in contact, an electro-magnet in the main circuit of the said lamp, and a system of leverage actuated by the said electro-magnet and acting when

the working-current passes to raise the upper members of both pairs at once, so as to initially separate them, with independent electro-magnets, one included in each of the said derived circuits, and armatures mounted upon the clutch-levers of the upper carbons, the electro-magnet in each derived circuit being placed so as to control that armature which is attached to the clutch-lever of the carbons of the other derived circuit, whereby the establishment of the arc in connection with either pair of carbons is caused to maintain the separation of the remaining pair of carbons.

2. In an electric-arc lamp, the combination of two sets or pairs of carbons, the members of both pairs being (when the lamp is not burning) in contact with each other, mechanism actuated by an electro-magnet in the main circuit for initially separating the members of both pairs at once upon the passage of the lighting-current through the said lamp, and retaining electro-magnetic devices for maintaining the separation of the idle carbons and for sustaining the weight of the upper members of the said idle carbons, said retaining electro-magnetic devices being controlled by the current maintaining the light between the other pair, whereby the lifting and regulating mechanism is relieved from the weight of the upper idle carbon.

3. The combination, with the main circuit, of the lifting-magnet included therein, the fine-wire magnet in the shunt-circuit, the two sets of carbons, the upper members thereof being carried upon independently-moving carbon-rods, the clutches—one for each rod—with their clutch-levers, the lifting-lever linked to the armature-levers of the lifting-magnet and feeding-magnet, and the retaining-magnets connected in circuit with the different sets of carbons, whereby when current is closed through the lamp the upper carbons are lifted together, the arc established between the members of one set, and the idle rod, its clutch, and clutch-lever lifted from the lifting-lever and retained in position during the burning of the arc first established.

4. The combination, with the bell-crank levers operated, respectively, by the lifting-magnet in the main circuit and the fine-wire magnet in the shunt-circuit, of the link connecting said levers with the lifting-lever, the clutch-levers resting normally on said lifting-lever, each clutch-lever being provided with an armature and each supporting a different clutch and carbon-rod, the retaining-magnets—one for each clutch-lever—said retaining-magnets being in circuit each with its diagonally-opposite sets of carbons, whereby when circuit is closed through the lamp the two upper carbons are first lifted and an arc established between one of the sets, and the clutch-lever of the idle rod lifted and retained by its retaining-magnet to relieve the lifting-lever of the weight of the idle rod, its carbon, clutch, and clutch-lever, substantially as and for the purpose specified.

5. The combination, with the centrally-placed lifting-lever, of the clutch-levers and clutches of the different rods normally supported thereby, the coarse-wire magnet in the main circuit, the fine-wire magnet in the shunt-circuit around the sets of carbons, the link mechanism connecting the armature-levers of said magnets with the central lifting-lever, and the retaining-magnets connected in opposite sides of the divided or multiple circuit through the lamp, said retaining-magnets having armatures upon the clutch-levers, respectively, whereby on closing circuit through the lamp the lifting-lever is raised to separate the different sets of carbons and establish the arc between one of said sets, while the circuit of the arc is closed through the retaining-magnet of the clutch-lever of the idle rod and the circuit of the other retaining-magnet opened by the separation of the pair of carbons not in service, substantially as and for the purpose specified.

6. In a double-carbon arc lamp, two carbon-rods, in combination with the circuit of the lamp, including both of said carbon-rods, two retaining-magnets, one included in circuit with each of said rods, each to be energized when current flows through its particular carbon-rod, the armatures of said retaining-magnets being connected reciprocally with the carbon-rod of the other to lift the said carbon-rod of the other when energized, substantially as and for the purpose specified.

7. In a double-carbon arc lamp, two carbon-rods, the circuit of the lamp including both of said carbon-rods, and two retaining-magnets, one included in circuit with each of said rods, each to be energized when current flows through its particular carbon-rod, the armatures of said retaining-magnets being connected reciprocally with the carbon-rod of the other to lift the said carbon-rod of the other when energized, in combination with a shunt around said retaining-magnet and arc, said shunt including a circuit-closing device controlled by the arc, whereby the said arc and retaining-magnet are shunted out of circuit automatically, substantially as and for the purpose specified.

In witness whereof I hereunto subscribe my name this 21st day of June, A. D. 1886.

CHARLES E. SCRIBNER.

Witnesses:

GEORGE P. BARTON,

JOSEPH S. KENNARD, Jr.